

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

REC'D 18 MAY 2004

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Applicant's or agent's file reference 34427WOP00	FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416).	
International Application No. PCT/AU2003/000073	International Filing Date (day/month/year) 24 January 2003	Priority Date (day/month/year) 25 January 2002
International Patent Classification (IPC) or national classification and IPC Int. Cl. ⁷ G01V 1/20, 1/38		
Applicant THALES UNDERWATER SYSTEMS PTY LIMITED et al		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 3 sheets, including this cover sheet.

☒ This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of 8 sheet(s).

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☐ Certain defects in the international application
- VIII ☐ Certain observations on the international application

Date of submission of the demand 8 July 2003	Date of completion of the report 7 May 2004
Name and mailing address of the IPEA/AU AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA E-mail address: pct@ipaaustralia.gov.au Facsimile No. (02) 6285 3929	Authorized Officer GREG POWELL Telephone No. (02) 6283 2308

I. Basis of the report**1. With regard to the elements of the international application:***

- ☐ the international application as originally filed.
- ☒ the description, pages 1-4, 7-21, as originally filed,
pages , filed with the demand,
pages 5, 6, received on 30 April 2004 with the letter of 30 April 2004
- ☒ the claims, pages , as originally filed,
pages , as amended (together with any statement) under Article 19,
pages , filed with the demand,
pages 22-27, received on 30 April 2004 with the letter of 30 April 2004
- ☒ the drawings, pages 1/12-12/12, as originally filed,
pages , filed with the demand,
pages , received on with the letter of
- ☐ the sequence listing part of the description:
pages , as originally filed
pages , filed with the demand
pages , received on with the letter of

2. With regard to the language, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language which is:

- ☐ the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of the translation furnished for the purposes of international preliminary examination (under Rules 55.2 and/or 55.3).

3. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

4. ☐ The amendments have resulted in the cancellation of:

- ☐ the description, pages
- ☐ the claims, Nos.
- ☐ the drawings, sheets/fig.

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).**

* Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17).

** Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**1. Statement**

Novelty (N)	Claims 1-46	YES
	Claims	NO
Inventive step (IS)	Claims 1-46	YES
	Claims	NO
Industrial applicability (IA)	Claims 1-46	YES
	Claims	NO

2. Citations and explanations (Rule 70.7)

Claims 1-46 meet the criteria set forth in the PCT for novelty, inventive step and industrial applicability.

The claims define an electronics module having an axial hole through the module to allow a seismic data acquisition cable to pass uninterrupted through the module length. Wrap-around circuitry is positioned in a space between the outer surface of the module and the axial hole. End fittings are connected to the module and also connect to part of the cable. An inner tube is positioned in the module to separate the circuitry-containing space from the cable space. Connections pass from the cable to the circuitry via an opening in the inner tube. This arrangement allows the circuitry in the module to be service without having to remove the module from the cable.

The closest prior art is considered to be EP 110230. This document discloses an electronics module that has an axial hole that allows uninterrupted passage of a seismic cable. It discloses space for wrap-around circuitry to be positioned in the module. It also has end fittings connected to the module and the cable. However, there is no disclosure of an inner tube to create a barrier between the circuitry and the cable, and no suggestion to provide one. Hence the claims are novel and inventive.

[AMENDED PAGE]

The preferred embodiment of the present invention is applicable to both ocean bottom cables and seismic streamers, as well as to both solid and liquid-filled cables.

The preferred embodiment provides an electronics-carrying module with a reduced outer dimension as compared to a conventional canister, but still having a
5 spacious curved interior for carrying bendable, wrap-around circuitry.

The preferred embodiment further provides the above mentioned electronics-carrying module with easy access to the wrap-around circuitry carried inside the electronic carrier. For example, the distributed electronics can be removed or serviced without decoupling or removing the electronics-carrying module, which is a distinctive
10 feature of the preferred embodiment of the present invention not available in the prior art.

Additionally, a preferred embodiment of the present invention provides an electronics packaging solution which accommodates an uninterrupted central strength member running along the entire length of an active section of seismic data acquisition
15 cables.

In accordance with a first aspect of the present invention there is provided an electronics-carrying module in a seismic data acquisition cable including:

an electronics carrier having access means for providing an easy-to-reach access to a wrap-around circuitry fitted inside a curved space within said electronics
20 carrier;

a pair of rigid end-fittings spaced apart axially by said electronics carrier for connecting to a section of said seismic data acquisition cable;

an axial hole formed in said electronics carrier and said rigid end-fittings defining said curved space between said axial hole, said access means and said rigid
25 end-fittings, said axial hole is formed for accommodating a cable with an uninterrupted strength member along said seismic data acquisition cable through said electronics-carrying module; and

an inner tube enclosing a major portion of said axial hole and having at least one opening thereon for connecting said wrap-around circuitry to said cable for both
30 power and signal transmission.

[AMENDED PAGE]

According to a second aspect of the present invention there is provided an electronics-carrying module including:

- a carrier defining a space for housing of electronics;
- selectively removable access means engagable with said carrier so as to
- 5 provide access to said space;
- a pair of end-fittings spaced apart axially by said carrier for connection of said module to a section of a cable;
- said cable having an axially extending strength member;
- a hole disposed along said module between said end-fittings, said hole
- 10 being sized so as to accommodate threading of said cable through said module such that said strength member extends axially through said module;
- an inner tube enclosing a major portion of said hole and having at least one opening thereon for connecting said electronics to said cable; and
- said access means being operable to provide access to said space without
- 15 decoupling or removing the module from the cable.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:-

1. [AMENDED] An electronics-carrying module in a seismic data acquisition cable including:

an electronics carrier having access means for providing an easy-to-reach
5 access to a wrap-around circuitry fitted inside a curved space within said electronics carrier;

a pair of rigid end-fittings spaced apart axially by said electronics carrier for connecting to a section of said seismic data acquisition cable;

an axial hole formed in said electronics carrier and said rigid end-fittings
10 defining said curved space between said axial hole, said access means and said rigid end-fittings, said axial hole is formed for accommodating a cable with an uninterrupted strength member along said seismic data acquisition cable through said electronics-carrying module; and

an inner tube enclosing a major portion of said axial hole and having at least
15 one opening thereon for connecting said wrap-around circuitry to said cable for both power and signal transmission.

2. [AMENDED] The electronics-carrying module in accordance with Claim 1, wherein said access means comprises:

a first fractional fluid-resistant tube fixed between said pair of rigid end-
20 fittings; and

a second fractional fluid-resistant tube joined to said first fractional fluid-resistant tube by sealing means so as to form said curved space between said inner tube and said access means.

3. [AMENDED] The electronics-carrying module in accordance with Claim 2,
25 wherein said second fractional fluid-resistant tube can be detached from said first fractional fluid-resistant tube by removing said sealing means.

4. The electronics-carrying module in accordance with Claim 3, wherein said first fractional fluid-resistant tube is larger in volume than said second fractional fluid-resistant tube.

5. The electronics-carrying module in accordance with Claim 3, wherein said first fractional fluid-resistant tube is smaller in volume than said second fractional fluid-resistant tube.

6. The electronics-carrying module in accordance with Claim 3, wherein said first fractional fluid-resistant tube is equal in volume to said second fractional fluid-resistant tube.

7. The electronics-carrying module in accordance with Claim 3, wherein said sealing means comprise an elastomer ring such as rubber ring.

8. The electronics-carrying module in accordance with Claim 3, wherein said sealing means comprise a waterproof sealant.

9. The electronics-carrying module in accordance with Claim 7 or 8, wherein said sealing means further comprise a plurality of securing means selected from the group consisting of screw, clip, band, magnet, suction and adhesive material.

10. [AMENDED] The electronics-carrying module in accordance with Claim 1, wherein said access means is a movable open-ended cylinder having a diameter slightly larger than said section of said seismic data acquisition cable so that said movable open-ended cylinder can slide away from said inner tube to expose said wrap-around circuitry, said movable open-ended cylinder is attached to said pair of rigid end-fittings by means of sealing and can be detached by removing said means of sealing.

11. The electronics-carrying module in accordance with Claim 10, wherein said sealing means comprise an elastomer ring such as rubber ring.

12. The electronics-carrying module in accordance with Claim 10, wherein said sealing means comprise a waterproof sealant.

13. The electronics-carrying module in accordance with Claim 11 or 12, wherein said sealing means further comprise a plurality of securing means selected from the group consisting of screw, clip, band, magnet, suction and adhesive material.

14. [AMENDED] The electronics-carrying module in accordance with Claim 1, wherein said inner tube is a cylindrical tube.

15. [AMENDED] The electronics-carrying module in accordance with Claim 1, wherein said inner tube is a polygonal tube.

5 16. [AMENDED] The electronics-carrying module in accordance with Claim 1, wherein said wrap-around circuitry comprises:

 a first circuit board with a connection for connecting said wrap-around circuitry to said cable through said opening; and
 means for securing said first circuit board to said inner tube.

10 17. The electronics-carrying module in accordance with Claim 16, wherein said wrap-around circuitry further comprises a second circuit board joined to said first circuit board by a connection means.

 18. The electronics-carrying module in accordance with Claim 17, wherein said wrap-around circuitry further comprises a plurality of other circuit boards joined
15 one to another to said first circuit board by said connection means.

 19. The electronics-carrying module in accordance with Claim 18, wherein said connection means comprise a bendable conductor selected from the group consisting of a bunch of wires in a ribbon cable and a flexible printed circuit board.

 20. The electronics-carrying module in accordance with Claim 18, wherein
20 said connection means comprise a fixed connector such as a pin-socket.

 21. The electronics-carrying module in accordance with Claim 16, wherein said first circuit board is a rigid circuit board.

 22. The electronics-carrying module in accordance with Claim 16, wherein said first circuit board is a flexible circuit board.

25 23. The electronics-carrying module in accordance with Claim 17, wherein said second circuit board is a rigid circuit board.

24. The electronics-carrying module in accordance with Claim 17, wherein said second circuit board is a flexible circuit board.

25. The electronics-carrying module in accordance with Claim 18, wherein said plurality of other circuit boards are rigid circuit boards.

5 26. The electronics-carrying module in accordance with Claim 18, wherein said plurality of other circuit boards are flexible circuit boards.

27. The electronics-carrying module in accordance with Claim 1, wherein said wrap-around circuitry includes amplifying circuitry.

10 28. The electronics-carrying module in accordance with Claim 1, wherein said wrap-around circuitry includes a data acquisition unit.

29. The electronics-carrying module in accordance with Claim 1, wherein said wrap-around circuitry includes an analog-to-digital converter.

30. The electronics-carrying module in accordance with Claim 1, wherein said wrap-around circuitry includes a multiplexing circuitry.

15 31. The electronics-carrying module in accordance with Claim 1, wherein said wrap-around circuitry includes a data transmission unit.

32. The electronics-carrying module in accordance with Claim 1, wherein said wrap-around circuitry includes active control circuitry.

20 33. The electronics-carrying module in accordance with Claim 1, wherein said wrap-around circuitry includes power supply circuitry.

34. The electronics-carrying module in accordance with Claim 1, wherein said section of said seismic data acquisition cable comprises:

 a portion of said cable; and

25 an outermost protective layer around said portion of said cable for protecting said cable from the outside environment.

35. The electronics-carrying module in accordance with Claim 34, wherein said rigid end-fitting is connected to said section of said seismic data acquisition cable by clamping said outermost protective layer to said rigid end-fitting.

36. The electronics-carrying module in accordance with Claim 34, wherein
5 said section of said seismic data acquisition cable further comprises a buoyant segment formed to fill the void underneath said outermost protective layer for providing a desired buoyancy level.

37. The electronics-carrying module in accordance with Claim 34, wherein
10 said section of said seismic data acquisition cable further comprises a layer of strength reinforcing member above said outermost protective layer, such as corrosion-resistant steel wire ropes.

38. The electronics-carrying module in accordance with Claim 36, wherein said buoyant segment includes a liquid material such as hydrocarbon fluid.

39. The electronics-carrying module in accordance with Claim 36, wherein
15 said buoyant segment includes a solid material such as polyurethane composite.

40. The electronics-carrying module in accordance with Claim 36, wherein said buoyant segment includes a gel-type material.

41. [AMENDED] An electronics-carrying module including:
a carrier defining a space for housing of electronics;
20 selectively removable access means engagable with said carrier so as to provide access to said space;
a pair of end-fittings spaced apart axially by said carrier for connection of said module to a section of a cable;
said cable having an axially extending strength member;
25 a hole disposed along said module between said end-fittings, said hole being sized so as to accommodate threading of said cable through said module such that said strength member extends axially through said module;

an inner tube enclosing a major portion of said hole and having at least one opening thereon for connecting said electronics to said cable; and

said access means being operable to provide access to said space without decoupling or removing the module from the cable.

5 42. An electronics-carrying module according to claim 41 wherein said carrier has a substantially cylindrical outer shell.

43. An electronics-carrying module according to claim 42 wherein said curved space is disposed intermediate said hole and said outer shell.

10 44. An electronics-carrying module according to any one of claims 41 to 43 wherein said electronics is wrap-around circuitry.

45. An electronics-carrying module according to any one of claims 41 to 44 wherein said access means is operable to provide access to said space without decoupling of the streamer at a termination point.

15 46. An electronics-carrying module substantially as herein described with reference to any one of the embodiments shown in the accompanying drawings.